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ABSTRACT

People of different cultures differ in the cognitive style they use. Research reports that Mexican American children indicate a preference for field-sensitive cognitive strategies that are spatial-holistic, and middle class children a preference for field-independent strategies that are verbal-analytic. Brain research in hemisphericity appears to be directly related to cognitive styles. Verbal-analytic strategies of the field-independent learners are similar to functions identified with left hemisphere processing, and spatial-holistic strategies of the field-sensitive learner are similar to functions identified with right hemisphere processing. Teachers are recognizing that instruction should be consistent with the way each child processes information and his/her cognitive style. In the 1980s, recognition that students do not learn with only one side of the brain has developed into a growing movement toward "whole brain" and "hemispheric integration" approaches. From this perspective, "learning styles" refers to the method of introducing material, not to the hemisphere to be educated. Students are highly diverse in their skills and abilities. It is apparent that selected methods of instruction are highly effective with some students, but not as effective with others. Subject matter may best be introduced through right or left hemisphere processes, but this is only the initial step--a gateway into the whole brain. (NEC)

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HEMISPHERIC LEARNING AND THE HISPANIC STUDENT

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Human beings have the most highly developed brain of all mammals. It is the learning capabilities of the human brain that makes man unique. Most functions of the brain involve the coordinated activity of many brain areas. But cognitive functions are centered in one major part of the brain- the cerebral cortex.

The cerebral cortex is the gray matter that forms the upper surface of the brain. It is the dominate part of the human brain. It is divided into right and left hemispheres. These hemispheres are joined by the corpus callosum, made up of some 200 million nerve fibers.

The fact that the human brain is made up of two halves was noted by Hippocrates in about 400 B.C. [1]. For a long time it was presumed that the functions of the brain were equally distributed.

Paul Broco in 1860's established the principle that the left hemisphere was responsible for producing language.The left hemisphere thus became regarded as the dominant or major hemisphere for all cognitive domains. The right hemisphere was believed to be inferior, lacking in any specific functions or skills of its own.

Early researchers interested in the structure and function of the brain began experiments with animals and ill or injured people. They began to learn about the hemispheres of the brain. They concluded that information passed across the corpus callosum to the two hemispheres. But by the 1950's there was a general feeling that the corpus callosum could be

destroyed with no apparent changes in behavior- thus we had two independent brains.

In the 1950's Dr. Roger Sperry and his students began split-brain experiments. They severed the hemispheric links and observed the split-brain animals. They found from their experiments that the corpus callosum had the means of transferring learning from one side to the other. Sperry wrote: It appears from the accumulated evidence that learning in one hemisphere is usually inaccessible to the other hemisphere if the commissures between the hemispheres are missing. This means that the corpus callosum has the important function of allowing the two hemispheres to share learning and memory. [2.]

In the 1960's, because results of animal experiments indicated that severing the corpus callosum did not seriously affect mental faculties, Dr. Bogen and Dr. Vogel performed several split-brain operations. They were performed to prevent the interhemispheric spread of epilepsy. The results revealed important information about the functioning of the two hemispheres. They found: interhemispheric exchange of information was totally disrupted; both hemispheres are involved in cognitive functioning; the left hemisphere possesses language and speech mechanisms and excels in verbal processing of information; the right has some language; excels in visual spatial tasks; is mute(nonverbal) but is capable of experiencing most of the activities that the left hemisphere experiences. [3.]

In the late 1960's the EEG (electrocephalogram) was used

to observe the electrical activity of the brain. In 1972 David Galin and Robert Ornstein at the University of California Medical Center tried recording EEG signals from the left and right sides of the brain separately while the subject did verbal or spatial tasks. When a large number of alpha waves appeared over a hemisphere it indicated that it was idling while the other hemisphere was working. This showed that normal people tend to think with one side of the brain or the other. [4.] The left hemisphere controls the functions of language, rational cognition, and sequential functions; the right hemisphere emphasizes intuitive thinking, and visual-spatial relationships and creativity.

By late 1970's a large majority of the researchers concluded that each side of the brain was a highly specialized organ of thought. Both hemispheres of the brain were capable of functioning independently and in a way that was different from the other. Further, these two hemispheres really did not work together in the same person. Instead, some people thought primarily with the left hemisphere, while others thought primarily with the right.

After hundreds of experiments, a pattern of functions of the two hemispheres emerged: [5.]

Left Hemisphere	Right Hemisphere
1. Verbal	1. Visual
2. Numerical	2. Spatial
3. Linear	3. Perceptual
4. Euclidean	4. Intuitive
5. Rational	5. Imaginative
6. Logical	6. Fantasy
7. Geometric	7. Imagery
	8. Sensory

The different functions of the two hemispheres were noted; but differences in how the two hemispheres process may be more important than what they process. The hemispheres use different strategies in dealing with incoming information. The left appears to process information in an analytic manner and the right in a holistic manner. The left processes information logically, the right subjectively. The left seems to process sequentially, the right simultaneously.

Paul E. Torrance in his book, Your Style of Learning and Thinking, summarized cerebral hemisphere functions in terms of styles of learning and thinking:

Left Hemisphere	Right Hemisphere
Responding to verbal instructions	Responding to visual instructions
Inhibited emotionally	Responds with emotion/feeling
Dependent upon words for meaning	Interprets body language
Produces logical ideas	Produces humorous ideas
Serious, systematic	Playful, uses humor
Abstract thinking	Concrete thinking
Likes to have definite plan	Likes to improvise
Not psychic	Highly psychic
Processes verbal stimuli	Processes kinesthetic stimuli
Processes information logically	Processes information subjectively
Critical/analytical in reading	Creative, synthesizing in reading
Logical in solving problems	Intuitive in solving problems
Gives information verbally	Gives information through gesture
Uses language in remembering	Uses images in remembering
Linear time	Non linear time
Recognizing names	Recognizing faces
Responsive to logical/verbal appeals	Responsive to emotional appeals

Students differ in the cognitive strategies they use.They are described as being field-dependent (field-sensitive), field-independent or bicognitive. The terms field-dependent

and field-independent emerged from research done in 1962 by Witkin, Dyk, Faterson, Goodenough and Karp. "In a field-dependent mode of perception, the organization of the field as a whole dominates perception of its parts; an item within a field is experienced as fused with the organized ground. In a field-independent mode of perception, the person is able to perceive items as discrete from the organized field." [6.]

To avoid negative connotations that might result from the word dependent, Ramirez and Castaneda in their studies of cognitive styles, substituted the word sensitive. They also refer to the possibility of simultaneous development of both cognitive styles in the same individual as bicognitive.[7.]

People of different cultures differ in the cognitive style they use. Ramirez and Castaneda report that Mexican American children indicate a preference for field-sensitive cognitive strategies that are spatial-holistic, and middle class children a preference for field-independent strategies that are verbal-analytic. The school behaviors observed most frequently in field sensitive and field independent children as presented by Ramirez and Castaneda are: [8.]

<u>Field-Independent Behaviors</u>

Relationship to Peers
1. Prefers to work independently
2. Likes to compete and gain individual recognition
3. Task orientated; is inattentive to social environment when working

Personal relationship to teacher
1. Rarely seeks physical contact with teacher
2. Formal; interactions with teacher are restricted to tasks at hand

Instructional relationship to teacher
1. Likes to try new tasks without teacher's help
2. Impatient to begin tasks; likes to finish first
3. Seeks nonsocial rewards

Characteristics of curriculum that facilitate learning
1. Details of concepts are emphasized; parts have meaning of their own
2. Deals with math and science concepts
3. Based on discovery approach

Field- Sensitive Behaviors

Relationship to peers
1. Likes to work with others to achieve a common goal
2. Likes to assist others
3. Is sensitive to feelings and opinions of others

Personal relationship to teacher
1. Openly expresses positive feelings for teacher
2. Asks questions about teacher's tastes and personal experiences; seeks to become like teacher

Instructional relationship to teacher
1. Seeks guidance and demonstration from teacher
2. Seeks rewards which strengthen relationship with teacher
3. Is highly motivated when working individually with teacher

Characteristics of curriculum that facilitate learning
1. Performance objectives and global aspects of curriculum are carefully explained
2. Concepts are presented in humanized or story format
3. Concepts are related to personal interests and experiences of children

Brain research in hemisphericity appears to be directly related to cognitive styles. The verbal-analytic strategies of the field-independent learner are similar to functions identified with left-hemisphere processing; and the spatial-holistic strategies of the field-sensitive learner are similar to functions identified with right hemisphere processing. Brain research increases the understanding of learning styles. The cognitive style of the learner is related to the processing mode(left and right hemisphere).

Many teachers are recognizing that instruction should be consistent with the way each child processes information and his/her cognitive style. Since the two are related teachers can provide improved instruction for more children by acknowledging cognitive styles and adapting teaching strategies to the student's dominant modes of processing.

Since Broca's report (1860's) on the importance of the left hemisphere for speech and Samuel T. Orton's research on difficulties in reading and writing (1937), attention has been focused on the left hemisphere. It was claimed that special subject matters and teaching strategies had to be developed to educate the "logical" left hemisphere. This over-emphasis on the left hemisphere still continues today in many classrooms. Elementary curriculum is primarily left brain orientated. In order to "balance" the curriculum, activities should reflect both left and right processing modes and utilize field-independent and field-sensitive teaching strategies, as much as possible. Teachers may need to make a conscious effort to structure activities with the right hemisphere processing mode in mind. To accomplish this sometimes means to use approaches and methods that are new to the teacher. Often it means modifying or using a familiar method in a new way. Many methods have potential for supporting right brain involvement. It is for the teacher to discover that potential.

Research suggests that approaches and methods which reflect one or more of the following criteria address the right brain. [9.]

Right Hemisphere Processing

Concrete--focus on the here and now; real experiences

Divergent--allowing for; divergent thinking

Fantasy

Free association

Holistic-- gestalt; global; setting language in meaningful context

Imagery (visual imagery)--seeing imaginary pictures"with your mind's eye."

Imaginative

Intuition

Music

Nonverbal--"physical responding in a three dimensional world" gestures, facial expression, body language

Sensory

Spatial--seeing things in space as related to other things

Field-Sensitive Strategies

Feelings are expressed.

Global presentation of concepts.

Group activities that allow students to work cooperatively together.

Personalized curriculum that: relates concepts and materials to the personal interests and experiences of students.; reflects ethnic and social background of students

Nonverbal

Humanized curriculum that: presents concepts in story format; uses humor, drama or fantasy; focus on human characteristics

We need to realize, however, that students do not learn with only one side of the brain. There is no evidence that people are purely "left-brained" or "right-brained". The left hemisphere may be more active in some people and the right hemisphere may be more active in others. But both hemispheres are involved in thinking, logic, and reasoning.

Today in the 1980's there is a growing movement toward the "whole brain" and "hemispheric integration" approaches. So much has been written in the last quarter century regarding the functional differences in the left and right cerebral hemispheres, that the importance of interhemispheric integration is often forgotton (Jerre Levy-1985).

The corpus callosum plays a critical role in the developmental organization of the cerebral hemispheres and in the regulation of arousal functions. [10] Arousal functions refers to the arousal of both hemispheres in making it possible for both hemispheres to process information at the same time. At times one hemisphere may be differentially aroused as individuals have a biased arousal of the left hemisphere or a biased arousal of the right hemisphere. But the two hemispheres work together with the corpus callosum serving to integrate the cognitive activities of the two simultaneously.

Research done by Joseph Hellige of the University of Southern California and his associates in the field of interhemispheric integration have shown that as tasks complexity increases, bilateral hemispheric engagement also increases. [11.] It is as if a single hemisphere is unable

to retain dominance when the task complexity is increased. When tasks are at simple level, bilateral activation may be at a low level, with reliance on a single hemisphere that receives only little use from the other side. But both hemispheres are engaged actively when the task is more complex.

Research in this area suggests a trend towards a "whole brain"philosophy. Both sides of the brain should be actively and simultaneously participating in the cognitive process. Whole brain learning still accounts for the processing differences in students in the extent to which children show a biased arousal to left or right hemisphere. In other words, the student with a biased arousal of the left hemisphere may gain reading skills more easily through a phonetic, analytic method, while the child with a biased arousal of the right hemisphere may learn to read better by the sight method. Jerre Levy is suggesting that only the "gateway" into whole-brain learning may differ for different children, <u>not</u> that one hemisphere or the other should be the object of education. [12.] Our aim should be to ensure that the child who learns to read through phonics will develop a fluent skill in sight reading, and the one who learns through the whole-word method will develop excellent skills at phonetic analysis.

From this perspective, "learning styles" refers to the <u>method</u> of introducing material, not to the hemisphere we want to educate. Students are highly diversed in their skills

and abilities. It is apparent that selected methods of instruction are highly effective with some students, but not as effective with others. Subject matter may best be introduced through right or left hemisphere processes, but this is only the initial step--a gateway into the whole brain!

We do not have half a brain nor two brains but one brain with each hemisphere contributing its specialized abilities. Hippocrates was right!

Day	Night
Analytic	Gestalt
Sequential	Simultaneous
Light	Dark
Time	Apace
Verbal	Spatial
Intellectual	Intuitive
Convergent	Divergent
Deductive	Imaginative
Rational	Metaphoric
Active	Receptive
Abstract	Concrete
Lineal	Nonlineal
Analytic	Holistic
Objective	Subjective
Left Hemisphere	Right Hemisphere

FOOTNOTES

1. Brown, Mark, Left Handed - Right Handed, page 52

2. Stevens, Leonard A., Explorers of the Brain, page 299

3. Sperry, Roger, "Left-Brain, Right-Brain", Saturday Review, Aug. 9, 1975 , pages 30-33

4. Blakeslee, Thomas R., The Right Brain, page 174

5. Spagnoli, Diana, A Review of the Literature in Brain Research in Hemisphericity, page39

6. Ramirez, Manuel and Castaneda, Alfredo, Cultural Democracy, Bicognitive Development and Education, page 65

7. Ibid., page 65

8. Ibid., page 134-135

9. Spagnoli, Diana, A Review of the Literature in Brain Research in Hemisphericity, page 95

10. Best, Catherine, Hemispheric Function and Collaboration in the Child, c page 11

11. Levy, Jere, "Research Synthesis on Right and Left Hemispheres:" Educational Leadership, page70

12. Ibid., page70

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